

WHAT IS CLAIMED IS:

Sub  
a17

1. An image processing method comprising:  
a step of determining a plurality of areas  
arranged in a predetermined direction on an image and  
5 each having a predetermined shape;  
a step of calculating a secondary difference value  
of density values representing the respective areas in  
said plurality of areas; and  
a step of judging one end point of an irradiation  
10 area from said secondary difference values calculated  
in said calculating step.

2. A method according to Claim 1, further  
comprising a step of determining said irradiation area  
15 from a plurality of end points of the irradiation area  
judged in said judging step.

Sub  
C57

3. A method according to Claim 1, wherein said  
density values representing the respective areas in  
20 said plurality of areas are average density values in  
the respective areas.

4. A method according to Claim 1, wherein said  
density values representing the respective areas in  
25 said plurality of areas are medians of density values  
in the respective areas.

65

sub  
CS7 5

10

15

20

5027

25

a step of evaluating the result of said detection, based on the result of irradiation ends detected for each of said plurality of areas.

5           10. A method according to Claim 9, wherein said detection is carried out using secondary difference values.

10           11. A method according to Claim 9, wherein said evaluating step is to judge whether said result of the detection is correct or not, using a variance.

5323 } 12. An image processing method for judging whether an object area in an image includes an irradiation area, said method comprising:

15

a secondary difference value acquisition step of acquiring secondary difference values from one-dimensional image data of said object area;

20 an irradiation end extraction step of extracting a coordinate of an end point of said irradiation area from the secondary difference values acquired in said secondary difference value acquisition step;

25 a comparison step of comparing the coordinate extracted in said irradiation end extraction step with a coordinate of an end point of the irradiation area included in said image, said coordinate being obtained preliminarily; and

a judgment step of judging whether said object area includes the irradiation area, based on the result of the comparison in said comparison step.

5           13. A method according to Claim 12, wherein said judgment step comprises a step of judging that said object area does not include the irradiation area, if the coordinates are close to each other, or otherwise judging that said object area includes the irradiation  
10           area.

50  
697  
15           14. A method according to Claim 12, further comprising an accumulated image data production step of producing projection of said object area as said one-dimensional image data,

              wherein said irradiation end extraction step comprises a step of carrying out processing for the one-dimensional image data obtained in said accumulated image data production step.

20           15. An image processing method for judging whether an object area in an image includes an irradiation area, said image processing method comprising:

              a coordinate indication step of providing an  
25           indication of a plurality of rows for which one-dimensional image data is to be extracted from said object area;

a secondary difference value acquisition step of acquiring secondary difference values from the one-dimensional image data of said object area according to the indication in said coordinate indication step;

5        an irradiation end extraction step of extracting coordinates of end points of said irradiation area from the secondary difference values acquired in said secondary difference value acquisition step;

10       a storage step of successively storing the coordinates extracted in said irradiation end extraction step;

an average acquisition step of acquiring an average of the plural coordinates stored in said storage step;

15       a comparison step of comparing the average of the coordinates obtained in said average step with a coordinate of an end point of the irradiation area included in said image, said coordinate being obtained preliminarily; and

20       a first judgment step of judging whether said object area includes the irradiation area, based on the result of the comparison in said comparison step.

25       16. A method according to Claim 15, wherein said first judgment step comprises a step of judging that said object area does not include the irradiation area, if the coordinates are close to each other, or

otherwise judging that said object area includes the irradiation area.

17. A method according to Claim 15, further  
5 comprising a second judgment step which is carried out based on the result of the judgment in said first judgment step,

wherein said second judgement step comprises a variance acquisition step of acquiring a variance of  
10 the coordinates stored in said storage step, a comparison step of comparing the variance obtained in the variance acquisition step with a predetermined value, and a judgment step of judging whether said object area includes the irradiation area, based on the  
15 result of the comparison in the comparison step.

18. A method according to Claim 16, wherein said second judgment step comprises a step of carrying out each of the steps when said first judgment step results  
20 in judging that said object area does not include the irradiation area.

19. A method according to Claim 15, wherein said irradiation end extraction step comprises a step of  
25 carrying out said extraction of coordinate, based on the sign, either positive or negative, of a primary difference value of said one-dimensional image data.

20. A method according to Claim 15, wherein said  
secondary difference value acquisition step comprises a  
step of carrying out said acquisition of the secondary  
difference values from said one-dimensional image data  
5 subjected to smoothing.

21. An image processing method comprising a  
coordinate indication step of indicating a row for  
calculation of characteristic quantities of two-  
10 dimensional image data, a characteristic quantity  
calculation step of calculating said characteristic  
quantities from data of the row indicated in said  
coordinate indication step, an end point extraction  
step of extracting an end point of an object area from  
15 the characteristic quantities calculated in said  
characteristic quantity calculation step, an end point  
storage step of storing coordinates of end points  
extracted in said end point extraction step, a rotation  
angle indication step of indicating an angle of a  
20 rotation axis onto which the end points stored in said  
end point storage step are projected, an accumulated  
quantity calculation step of calculating projection of  
the end points stored in said end point storage step  
onto said rotation axis of the angle indicated in said  
25 rotation angle indication step, an accumulated quantity  
storage step of storing a projection quantity onto said  
rotation axis, calculated in said accumulated quantity

calculation step, and a rotation angle judgment step of judging a rotation angle of the object area from said projection quantity stored in said accumulated quantity storage step.

5

22. A method according to Claim 21, wherein a start point of said rotation axis onto which the end points stored in said end point storage step are projected is placed at a barycenter of image data not less than a fixed density value.

10

Sub D1

23. An image processing apparatus comprising:  
means for determining a plurality of areas arranged in a predetermined direction on an image and each having a predetermined shape;  
means for calculating a secondary difference value of density values representing the respective areas in said plurality of areas; and  
means for judging one end point of an irradiation area from said secondary difference values calculated by said calculating means.

15

20

24. An image processing apparatus for extracting an irradiation area in an input image, said image processing apparatus comprising:

25

means for detecting an irradiation end, based on a density distribution in each area, for a plurality of



*Sub D1*  
*Continue*

areas in a desired direction in said image; and  
means for evaluating the result of said detection,  
based on the result of irradiation ends detected for  
each of said plurality of areas.

5

25. An image processing apparatus comprising  
coordinate indication means for indicating a row for  
calculation of characteristic quantities of two-  
dimensional image data, characteristic quantity  
10 calculation means for calculating said characteristic  
quantities from data of the row indicated by said  
coordinate indication means, end point extraction means  
for extracting an end point of an object area from the  
characteristic quantities calculated by said  
15 characteristic quantity calculation means, end point  
storage means for storing coordinates of end points  
extracted by said end point extraction means, rotation  
angle indication means for indicating an angle of a  
rotation axis onto which the end points stored in said  
20 end point storage means are projected, accumulated  
quantity calculation means for calculating projection  
of the end points stored in said end point storage  
means onto said rotation axis of the angle indicated by  
said rotation angle indication means, accumulated  
25 quantity storage means for storing a projection.  
quantity onto said rotation axis, calculated by said  
accumulated quantity calculation means, and rotation

angle judgment means for judging a rotation angle of the object area from said projection quantity stored in said accumulated quantity storage means.

SubDI  
Continues 3

26. A storage medium storing a program for carrying out an image processing routine comprising:

a step of determining a plurality of areas arranged in a predetermined direction on an image and each having a predetermined shape;

10 a step of calculating a secondary difference value of density values representing the respective areas in said plurality of areas; and

15 a step of judging one end point of an irradiation area from said secondary difference values calculated in said calculating step.

27. A storage medium storing a program for carrying out an image processing routine for extracting an irradiation area in an input image, said image processing routine comprising:

20 a step of detecting an irradiation end, based on a density distribution in each area, for a plurality of areas in a desired direction in said image; and

25 a step of evaluating the result of said detection, based on the result of irradiation ends detected for each of said plurality of areas.

28. A storage medium storing a program for  
carrying out an image processing routine comprising a  
coordinate indication step of indicating a row for  
calculation of characteristic quantities of two-  
5 dimensional image data, a characteristic quantity  
calculation step of calculating said characteristic  
quantities from data of the row indicated in said  
coordinate indication step, an end point extraction  
step of extracting an end point of an object area from  
10 the characteristic quantity calculated in said  
characteristic quantities calculation step, an end  
point storage step of storing coordinates of end points  
extracted in said end point extraction step, a rotation  
angle indication step of indicating an angle of a  
15 rotation axis onto which the end points stored in said  
end point storage step are projected, an accumulated  
quantity calculation step of calculating projection of  
the end points stored in said end point storage step  
onto said rotation axis of the angle indicated in said  
20 rotation angle indication step, an accumulated quantity  
storage step of storing a projection quantity onto said  
rotation axis, calculated in said accumulated quantity  
calculation step, and a rotation angle judgment step of  
judging a rotation angle of the object area from said  
25 projection quantity stored in said accumulated quantity  
storage step.

Add  
C5

ADD  
C5

Add D1